Radio sensors and electric storms: Scientific metaphors in media talks

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1. Abstract

Metaphors play an important role in communicating research to professional and lay audiences and are frequently used by journalists to present research in familiar terms. Previous studies of metaphors in science news have examined edited press reports and the use of metaphors by journalists. However, this study looks into the use of metaphors by scientists interviewed in live broadcasts. Using conversation analysis, interviews are explored for the insertion of metaphors by scientists or their uptake of metaphors that their hosts introduce. Metaphor use is shown to respond to the interactional context and participants' roles in communicating the topic reported.

Keywords: Metaphor, News Interviews, Conversation Analysis, Formulation, Repair.

2. Introduction

Metaphors play an important role in communicating and explaining scientific research to professional and lay audiences (Keller, 2002, Van Rijn-van Tongeren, 1997, Camus, 2009). Journalists use metaphors to cast research in terms that resonate with familiar vocabulary and the perceived interests and level of understanding of their audience (Väliverronen & Hellsten, 2002, Jensen, 2012). By evoking concrete images and appealing to the emotions, metaphors provide a common ground between scientists, the media and the public. They are thus deemed useful for explaining difficult concepts or in framing the reported discoveries.

Metaphors are used extensively in science as well. Scientists use metaphors as a way of translating the illusive, non-intuitive phenomena that they study into terms that are congruent

with daily experience and vocabulary (Van Rijn-van Tongeren, 1997, Väliverronen, 1998, Leary, 1990, Keller, 2002). While many metaphoric expressions (e.g. “the genetic program”, “biological clock”) are now used as conventional terms, others are produced in ways that align with the new topics, concepts and mechanisms (Semino, 2008). Their semantic ambiguity makes metaphors especially useful as scientists often communicate about obscure entities and processes about which little is yet known (Keller, 2002, Journet, 2010, Stelmach & Nerlich, 2015).

In addition, scientists who communicate with the public have been shown to use metaphors as a way of linking the content explained with concepts and experiences that are familiar to their audiences (Semino, 2008). The metaphors that scientists use are often picked-up by journalists from academic papers, commentaries or press releases (Nerlich & Halliday, 2007, Nerlich & Koteyko, 2009, Stelmach & Nerlich, 2015). However, while popular science studies have examined the metaphors that authors use (Semino, 2008, Kapon et al., 2009) analyses of news reports have focused primarily on how journalists, rather than experts, use these metaphors when presenting research or expert advice (Woods et al., 2012, Atanasova & Koteyko, 2015).

To examine how scientists use metaphors in science-media contexts this study tracks their insertion and uptake of metaphors in the expert interview in the news. The expert interview is a key resource for eliciting background information or independent comment on the events of the day or to introduce new research to the general public (Montgomery, 2008, Albaek, 2011, Armon & Baram-Tsabari, 2016). Along with live broadcasts, interviews are important tools for news gathering, and are used for eliciting information, quotes and soundbites (Ekström & Lundell, 2011, Verhoeven, 2010). Despite their prominent role in presenting science,

metaphors have only been examined in edited reports which show that journalists often borrow the metaphors that experts use to frame their research or their advice that appeared in previous publications or interviews (Nerlich & Halliday, 2007, Stelmach & Nerlich, 2015). Nevertheless, the suitability of their selection and use by experts to explain their research in the mass media has not been explored systematically. By examining news interviews with scientific experts this study analyses the insertion and uptake of metaphoric expressions as a response to the interactional context in which they are used and the objectives pursued by experts and journalists.

3. Theoretical framework

This study adopts a discourse-pragmatic approach to metaphors that examines their use in specific settings and as responding to the speakers' communicative goals (Kupferberg & Green, 2008, Cameron & Stelma, 2004, Cameron, 2008). In doing so it departs from previous studies of scientific metaphors that relied in the main on Conceptual Metaphor Theory (CMT; Lakoff & Johnson, 1980). In CMT, a metaphor is defined as a cognitive relationship between a familiar context (the source domain) and the topic that speakers or writers wish to convey (the target domain). For example, a study of genetics reporting (Nerlich & Hellsten, 2004) found that journalists often describe genes or genomes (the target domains) in terms of codes or maps (the source domain). These terms simplify genetic explanations but also contribute to the social representation of the reported research. By representing researchers as "mappers" of genes, their search is represented as meticulous and accurate (Petersen, 2001). But while CMT studies showed how metaphors support or question scientific view-points (Woods et al., 2012, Atanasova & Koteyko, 2015) this approach is less suitable for exploring their strategic use to achieve more specific interactional goals.

Discourse studies of science learning have noted that teachers and children interact in selecting metaphors when making factual observations and in explaining and coming to grips with scientific concepts (Cameron, 2003, Pramling, 2010, Close & Scherr, 2015). For example, Cameron showed how a geology teacher and his students used metaphors to understand how volcanic lava turns into rock formations. This was done by comparing lava to familiar objects (runny butter, wax) to account for how lava can cool into rock (Cameron, 2003). Though analogies are often studied as sense-making or reasoning devices (Marcu et al., 2015) Schwarz-Plaschg (2016) demonstrated how they are used as persuasive tools for building scenarios, delimiting atopic, justifying actions or closing debates. Rather than seeing metaphor as a static connection between target and source domains instances need to be examined "as arising from the particular communicative needs of the specific discourse participants at the moment when the metaphor is used" (Cameron, 2003, 27).

Following Cameron (2003) a metaphor is defined as a figurative term (vehicle) which is incongruous with the surrounding discourse (topic) and where this tension can be resolved by some transfer of meaning between them. While the concepts of target and source refer to cognitive, ideational, domains, topic and vehicle are specified in the discourse itself. Accordingly, the study of discursive environment is examined for how metaphors are marked as such. While CMT examines implicit mappings between concepts (Semino, 2008), scientists and teachers often use analogies and similes in which the domains for comparison are stated explicitly (Gentner et al., 2001, Cameron, 2003, Skorczynska & Ahrens, 2015, Pramling, 2010). The discursive approach as applied here searches for signals such as "a kind of", or "really", where speakers mark the terms they want to be interpreted more or less metaphorically (Goatly, 1997, Cameron & Deignan, 2003, Skorczynska & Ahrens, 2015).

To examine how metaphor use reflects interactional goals, exchanges with embedded metaphors were examined using Conversation Analysis. Conversation Analysis (CA) is geared at discovering how participants understand and respond to one another in their turns at talk (Heritage, 2008). Though research in CA has only rarely dealt with issues of linguistic meaning in interactions, semantic work can be evidenced when participants specify, generalize, correct or negotiate some expression or description produced in a prior turn (Deppermann, 2011). Through their talk, speakers can display aspects of their understanding of what has been referred to in the immediately preceding turn or what has occurred earlier or elsewhere that nonetheless figures in the turn's talk (Schegloff, 1992). A previous study on the use of idiomatic expressions showed that these occur regularly in topic transitions, thereby initiating the closing of a topic (Drew & Holt, 1998). Rather than inferring expert's interpretations of metaphors (Close & Scherr, 2015) this study focused on the agenda that was driving the exchanges in which metaphors were deployed .

4. Data and Methods

The data for this study were taken from a corpus of 150 naturally occurring recorded and transcribed studio interviews conducted in Hebrew on the current affairs talk-show *London et Kirschenbaum* from 2009 to 2011 (Armon & Baram-Tsabari, 2016). Broadcast on a national commercial channel in Israel (Channel 10) *London et Kirschenbaum* is a highbrow pre-primetime news magazine (Hamo, 2015) which is one of Israel's key agenda-setting news broadcasts. The program is mainly hosted by veteran journalist and presenter Yaron London and was co-hosted by the late Moti Kirschenbaum, a former director-general of the Israel Broadcasting Authority and one of the founders of Israeli television. Though primarily

dedicated to hard news, the program is exceptional in terms of its quality coverage of science and technology topics compared to other news outlets in Israel (Barel et al., 2015).

Data for this study was collected over the course of a broader study of the reporting strategies of scientific experts in the Israeli media in which the *London et Kirschenbaum* was taken as a case study. Alongside the use of narrative (Armon & Baram-Tsabari, 2016), metaphors emerged as a recurrent tool for explaining research to the audience. Although previous studies of metaphors in science media messages have explored the coverage of particular topics (e.g. epigenetics; Stelmach & Nerlich, 2015), this corpus contained reports on a variety of research disciplines. The focus on *London et Kirschenbaum* means that the patterns identified may not apply to scientific discourse in other media systems or national contexts. However, it offers a unified context in terms of the discursive environment and interactional roles that scientists need to work with in communicating their research.

To identify metaphors, transcripts were searched for expressions whose basic or physical meaning as is found in their dictionary entries differed from the contextual meaning inferred to apply in the situation in which it was used (Steen et al., 2010).[i] For example (excerpt 3, below), a researcher describing his genetic research used the expression "gene hunting" (heb. (Hebrew) *zeidgenim*) to describe his efforts. The basic (dictionary) meaning of hunting is "the activity of the hunter, the chasing of animals with the purpose of capture, killing or sport" (Choueka, 1997) whereas the inferred meaning was that of a meticulous search. The incongruence with the topic term (genes) in this context indicated a metaphoric use and the identification of "hunting" as a vehicle term. Further, a distinction was made between novel and conventional uses of a metaphor. If the dictionary included the contextual meaning in the term's entry, the metaphor was designated as conventional; otherwise it was designated as novel. For example, the entry for term "hunting" does not include searching activity.

Therefore, its use as in the example above was tagged as novel even though the term is used in this meaning in science and popular science (see below).

The search identified 128 sequences in which metaphoric expressions were subject to some form of interactional engagement. These were examined for the pattern of their occasioning by experts or their response to metaphors that their interviewers introduced. Their marking was examined for signals (e.g., 'a kind of', or 'really') indicating that the vehicle term was presented to be interpreted more or less metaphorically (Goatly, 1997, Skorczynska & Ahrens, 2015). Vehicle terms were also examined for their clustering, replacing or modifying (Cameron & Stelma, 2004, Cameron, 2008) as well as extended confirmations and other responses that indicated a search for or negotiation of the meaning of the metaphors.

To identify the interactional relevance of vehicle replacements or modifications, i.e., their use accomplishing communicative tasks, this study used the CA notion of repair. In CA repair is defined as the interruption of an ongoing course of talk in order to attend to possible trouble in speaking, hearing or understanding (Schegloff et al., 1977) is particularly useful here. The repair process consists of treating an utterance as a source of trouble and remedying it in the form of a repeated or corrected formulation within a narrowly defined temporal space (Drew et al., 2013, Kitzinger, 2012). The following excerpts illustrate two cases of repair. In excerpt (henceforth ex. 1) a scientific term (stress; heb. *aka*) is replaced by the conventional metaphor (‘pressure’; heb. *lachatz*). In ex.2, a scientific term (‘receptor’, l.2; heb. (eng.) *rezeptor*) is presented as more appropriate than the metaphoric term “site” (heb. *atar*). The purpose of these repairs was unclear and could not be determined satisfactorily from these utterances alone. However, they do not appear to have been used to correct a mistaken term but rather to align with the interviewee's (IE) interactional project[ii]:

ex.1 elephants & evolution, 12.12.11

1 IE. We are looking for the stress (0.2) where the pressure came from

ex.2 marijuana & memory, 5. 9.8.09

1 IE. the active substance affects a particular site hhhh. and now they discovered that
2 activating this site hh. this receptor hhh. influences

While as in ex.1 and 2 repairs can be initiated by the current speaker they can also be introduced by the recipient of a turn-at-talk. By examining the sequential environment of repairing or repaired metaphors, their selection and uptake is related to the tasks that these metaphors were used for accomplishing. Metaphors were analyzed either as repairs of the immediately preceding term or as repair of the expression itself. To identify the interactional relevance of vehicle repairs, i.e., their use accomplishing communicative tasks, cases that did not involve an issue of pronunciation or comprehension were selected.

The relevant exchanges were transcribed with close attention to the context of their talk and behavior to identify how the metaphors were introduced and responded to. Following CA conventions, the transcription noted changes in pitch, loudness, tempo and emphasis, pauses or overlaps between turns, and embodied cues in the form of gestures and gaze shifts. In this way, an attempt was made to represent talk as it is produced, not as it might have been intended or as it 'should' have been produced (Hepburn & Bolden, 2012) and to locate the metaphors produced as components of sequentially accomplished tasks.

5. Observations

a. Organizing accounts

In excerpts 3-5,the researchers introduced metaphors as organizing elements used to give coherence to the explanation or description rather than describe certain entities or processes (Journet, 2010). Such metaphors were observed to drive entire accounts, from description to explanation, in that their selection reflected the key message, story or interpretation that the speakers sought to convey (Antaki, 1994). The examples demonstrate not only the centrality of these types of metaphors to the accounts that experts deliver but how they are selected and marked in relation to the goals that experts pursue.

Ex. 3 was taken from an item reporting on the interviewee's discovery of a gene for a rare and untreatable disorder. The item celebrated the life work of the interviewee and a prestigious scientific award that he had recently won for identifying the gene and his contribution to the study of this disease. The excerpt formed part of a story told by the interviewee about his search for this gene (see Armon & Baram-Tsabari, 2016 for a comprehensive account). As can be seen in lines1 and 2, he used the term "gene hunting" to frame this search as an actual hunt:

ex.3. the A.T. disease 6.3.11

1 IE. hhh. (0.2) and you fish them one by o:ne and it's called it's really hunting it's called
2 gene hunting ((eng.)) (0.2) zeidgenim ((heb= gene hunting)) (0.1) hhh. and then you
3 with (0.5) three four five ten genes all of which are mapped to the same area but only
4 one of them is the gene you are looking for

In describing his research, the interviewee replaces the vehicle term "to fish" with "really hunting" (heb. *mamashza'id*, l.1) thus marking the term "gene hunting" (l.2) to reinforce the literal understanding. The use of the English term in the Hebrew context and its marking as cited ("it's called", heb. *zenikra*, l.1) presents "gene hunting" as a scientific term. But by repairing this marking as part of the indexing of an actual hunt ("it's really", heb. *zemamash*)

and its translation to Hebrew (l.2) the interviewee projects the conventional meaning of a hunt. Though scientists use gene hunting to depict a highly complex procedure (Geschwind & State, 2015) it has also been used in the news media to present geneticists as involved in a quest to unlock the secrets of nature (Petersen, 2001). Its use here shows how the expert applied the term not only to explain his research but also to frame its meaning in terms that the audience would likely be familiar with.

Excerpt 4 is drawn from an item discussing addiction to shopping and the treatment the interviewee uses in his clinic. At the start of the interview, the interviewers presented shopping addiction as a topic taken from the popular press and questioned whether it should be taken seriously. However, the interviewee, who is a psychiatrist, countered this position by presenting this addiction as a mental disorder. For this purpose, he described the imbalance in the brain areas that may cause this addiction. Later in the interview he explained that his treatment targets these areas:

ex.4. shopping addiction, 24.1.10

1 IE. There is a second system which is (.) a system of motivation and reward in most cases
2 in most of the [addict](ions))
3 YL. **[motivation] and [reward]**
4 IE. [reward] [ye↑s]
5 YL. [yes]
6 (0.3)
7 IE. hhh. reward system ((eng.)) in Eng[lish]
8 YL. [yes]
9 IE. that is motivation and reward e::::h (.) >and there's ano↑ther system that that a system
10 of brakes let's define it in that wa↑y<hhh. breaks ((eng.)) as well as hand-brakes
11 ((eng.)) in differ[rent] ar↑eas in the brain hhhh. [we] first of all examine
12 YL. [yes] [yes]

Two metaphors are introduced to explicate two systems in the brain. The first is presented as a system of "motivation and reward" (heb. *hana'avepras*, l.1-9) and the second as a system of brakes (heb. (eng.) *breks*, l.10-11). The first metaphor is marked ("which is"; heb. *she'hi*, l.1) as a literal description of the neural mechanism. London's repeat (l.3) can be understood

either as indicating a problem of hearing or understanding as often observed in ordinary talks (Kitzinger, 2012) or as a way of presenting the term to the audience. However, it is treated by the interviewee as questioning his choice of term, which he subsequently affirms (l.4) but leaves unexplained. The repeats (l.4, 9) and the citing of the professional (English) form (l.7) presents this term as scientific but as self-explanatory and as an adequate description of the first system in the brain.

However, the braking metaphor that describes the second system is identified as unfamiliar and thus as inviting some form of joint ratification (let's define it in this way; heb. *bo'unagdir et zebe'tsurakazo*, l. 10). Because the term 'brakes' references the braking systems of cars, its metaphoric use here is novel whereas the reward metaphor is a conventional term. However, the interviewee projects this term almost as a literal description of the system in the brain that is being described (l.11). Though treated differently, the insertion and marking of both expressions seem to reflect the closing of an account rather than a search for an accurate explanation. Instead their metaphoric framing seems geared at presenting the syndrome as legitimate and treatable.

In ex.5 the metaphors appear to be oriented toward an elaborate and detailed explanation rather than the structuring of a narrative as in ex.3 or the closing of an account as in ex.4. The interviewee presented her study of smell-sensing neurons and uses metaphors in an elaborate explanation of what these neurons are and how they function. This explanation follows an exchange in which she responded to a description of her study by the interviewers by arguing that a more accurate description was called for. In explaining what was "actually" (l.1) discovered the interviewee describes the nerve cells as sensors (heb. *khaishanim*, l.1) which is

a conventional metaphor. However, the delivery of this and other terms evidences a search for an accessible analogy that allows the actual explanation to be delivered:

ex.5 smell measurement, 9.10.11

1 IE. e:h actually what we disco↑vered is these senso↑rs if we'll think on e:::h
2 ((gazes at anchors))
3 these sensors (.) like on e:::h (0.2) hh. e:::::hm (0.4) radio sensors if we wish (.) yes
4 ((gazes at anchors))
5 e:h or a radio antenna then we asked ourselves (.) to what are they (0.2) hh. on
6 ((gaze at anchors))
7 on what↑ frequency do they listen to what are they (.) paying attention to

The word search begins with the term 'sensors' that is repaired sequentially from "radio sensors" (heb. *khaishanei radio*, l.2) and then to "radio antenna" (1.3; heb. *antenat radio*). This term is then developed with the term "frequency" from the source domain of radio (heb. *tedierut*, l.4) to which the sensors "listens" (heb. *ma'azinim*). The pauses, disfluencies and suggestive markings (if we think, l.1-> wish, l.2) joined with gaze shifts towards interviewers indicate that these expressions were chosen to coincide with what they are understood to treat as an adequate clarification. Although metaphors tend to be chosen to correspond to shared experiences or understandings, scientific concepts that are inaccessible call for special consideration(Semino et al., 2013). This section illustrates that the selection of terms and their marking as literal or metaphorical is responsive to the interactional role of the explanation of which they form part.

b. Brief clarifications

Though the scientists often introduced their metaphoric expressions to support an explanation they were crafting, they often accepted the interviewers' formulations as adequate. In the following examples metaphors were introduced by the interviewers to formulate a particular concept or process that the interviewees were explaining. The overlapping turns in these excerpts demonstrate that interviewers' terms were introduced while the explanation was

underway. Unlike in the previous examples where the scientists produced both explanations and the metaphors embedded in them, here they provided the explanation but they adopted the metaphors introduced by the interviewers.

Excerpt 6 is taken from a report on a study conducted by the interviewee which showed that operations to remove cancerous tissues could actually trigger metastatic spread. The interviewee presents the key question of interest for him, which is why the operation causes metastatic tumors. However, Kirschenbaum frames the operation as a catalyst (heb. (eng.) *catalizator*; l.4). Though this term is ratified by the interviewee (l.5), the confirmation implies a preference for pursuing the disrupted utterance rather than agreement as to its suitability as meaningful description:

ex.6. metastasis reduction, 15.3.11

1 IE. now the quesio:::n↑ (.) e:::h is indeed (.) e:::h what causes hh. tha:t (0.2) hh. that the
2 surgery (.) constitutes a risk↑ factor for the development of cancerous metastases
3 (0.4) [meaning]
4 MK. [it is a ca]talyst the operation [itself is a catalyst]
5 IE. [exactly yes correct] so-

Excerpts 7.1 and 7.2 demonstrate how the confirmations align with the interviewee's discursive goal. The excerpts are taken from an item discussing a study where the researchers claimed to have discovered how animals hibernate. The issue is presented as a mystery that scientists have been probing for years but before the discovery is discussed, the interviewee is asked to explain why animals hibernate in the first place. In the following excerpt, taken from her response, she explains hibernation as an adaptation to situations in which sources of energy are limited and where the animal needs to "do a pause" (l.5). However, Kirschenbaum uses the term "freezing mechanism" which the interviewee confirms in both excerpts but with differing ratifications:

ex.7.1 human hibernation, 31.7.11

IE. There's a possible situation that the availability of energy that the animal↑ has is lower hh. than its needs hhhh.=
YL. Aha=
IE. and then the options↑ he[1] has is either:::r (.) to die (.) of starvation (0.3) hh. o:::↑r actually >to halt his life to do a pause↑ ((eng.)) < (0.1) hh. >to go into a state of< hibernation >to reduce his energy↑< and so actually to go through the (.) the:: inconvenient [or unsuitable period]
MK. [To get into the freezer]
(0.2)
IE. Exactly↑ (.) to get into↑ the freezer↑ [>°it doesn't have to be a freezer°<]
YL. [Now what does this say] What is the situation of the:: (.) bear or other animals hhh. at hibernation ((eng.))

ex.7.2 human hibernation, 31.7.11

IE. exactly↓ imagine that to a:n ambulance driver or to:: e::h or to a paramedic on ambulance will have a material that he can inject↑ to to the patient >to reduce↑ his body temperature to reduce↑ his energy consumption and actually to stop↑ all of the processes< that cause a a damage (.) hhhh.-
MK. To freeze↑ the situa[tion↓]
IE. [To fr]eeze↑ the situation↑=
YL. =Now what so this substance that they injected to squirrels predicts such as procedure

In ex.7.1 the interviewee explains animal hibernation in terms of pausing and reducing of activity and energy consumption (l.5-7). While her explanation is under way, the interviewer formulates this mechanism as "getting into the freezer" (heb. *le'hikanes la'makpi,* l.8). In ex.7.2, the interviewee presents a treatment that is likely to be developed and this effect is formulated by Kirschenbaum as "freezing the situation" (heb. *lehakpi et hamatzav*, l.5). While in ex.7.1 she qualifies the expression (l.10) in ex.7.2 she aligns with Kirschenbaum and ratifies his expression (l.6). The similarity in target and source suggests that this different treatment reflects interactional rather than semantic issues. In ex.7.1 the interviewee is interrupted while presenting a textbook explanation for hibernation and may have tried to orient toward the scientific accuracy of the terms and their meanings. However, her footing in

[1] The use of masculine or feminine pronouns for non-human entities, though ungrammatical in English, is conventional in Hebrew and is translated as in the source.

ex.7.2 is that of a joint construction of a hypothetical scenario (imagine; heb. *ta'er le'atsmekha*, l.1) which Kirschenbaum is allowed to contribute to and suggest a suitable formulation for the audience.

Whereas the excerpts from item 7 demonstrate different responses to a similar vehicle term, in ex.8 the interviewee ratifies different vehicle terms for the very same topic. The excerpt is taken from a report on a sound-based guidance system for the blind that the interviewee developed. Here he introduces the principle of using auditory cues for "vision" by explaining first how the brain can convert signals from one sense to another. London interrupts this explanation and formulates this conversion, first as translation (l.2; heb. *metargem*) and then as encoding (l.4, heb. *mekoded*). This self-repair suggests that London understands these concepts convey different meanings and that this difference affects his formulation. However, the interviewee can be seen to be treating both as one and the same:

ex.8 echolocation, 18.1.10

1 IE. you take information from o↑ne sense (.) hhh.-
2 YL. Trans[°lates it°]
3 IE. [and ((you)) hear] it translates [it to:]-
4 YL. **[enco]des [it]**
5 IE. [en]codes it
6 in the seco↓nd [sense] et cetera (0.3) hhhh. e:h so:::-
7 MK. [yes yes]

The translation metaphor (l.2) is repeated by the interviewee as a way of confirming this term for his explanation (l.3). But while this confirmation is underway the interviewer repairs his term to the encoding metaphor (l.4). The interviewee also ratifies this formulation as well (l.5) despite the significant differences in the lexical definitions between translation and encoding.[iii] Thus, confirmations seems to respond to the particular interactional task underway rather than the identification of an "adequate" explanation for sensory conversions in the brain.

c. Adaptable resources

As shown, metaphors were used in framing the accounts that experts introduced or to clarify a certain concept or process. Depending on their use, the experts marked and developed vehicle terms or accepted the formulation offered by interviewers. In some instances, the experts adapted rather than merely confirmed the metaphors that the interviewers proposed. Metaphors have been shown to be borrowed from academic publications and be reused and adapted to a variety of audiences and communicative purposes, both by popular authors and journalists (Nerlich & Halliday, 2007, Stelmach & Nerlich, 2015). The examples below show how the scientists adopted the metaphors that the journalists produced to complete their explanatory or framing tasks.

Excerpt 9 is taken from an interview that challenged the popular use of anti-oxidant additives based on a recent study which argued that these supplements do not help prevent diseases. The interviewee, a clinician, was asked to provide expert commentary on the study, including the negative effects of free oxygen. This effect was described by London as "eating us" (heb. *okhelotanu*, l.3) and as eating tissues (*rekamot*, l.4) by the interviewee. This repetition specifies the description offered by London while marking this explanation as complete. In the next turn the interviewee shifts the focus to a new topic (how oxygen is measured rather than its pathological effects):

ex.9. anti-oxidants, 23.2.09

1 IE. That is free oxygen=
2 MK. ºYesº
3 YL. <**What does he do he eats↑ us>**
4 IE. He eats >ti(.)ssues<
5 (.)
6 YL. Aha=
7 IE. It's possible >to measure< it

A similar form of incorporation and adaptation of an interviewer's metaphor appears in excerpt 10. The excerpt is drawn from a report on an apparatus developed by the interviewee enabling transmission and reception of brain signals at a distance. He presents the apparatus as having been developed as an offshoot of a diagnostic tool for epilepsy. In this explanation, he uses the term epileptic seizures (l.1-2) that London presents as "an electric storm in the brain" (l.3, heb. *se'ara khashmalit bamoakh*). The interviewee incorporates this term while correcting it as an adequate description of seizures and resumes the focus on the method and its purpose:

ex.10. imaging thoughts, 7.11.10

IE1. they wait for the seizu↑res to take pla↑ce and then we can bring into focus (.) hhh. and see [where from the seizures are coming]

YL. [seizures is an electric storm] in [the brain↓]

IE. >[an e]lectric storm that begins in the brain< (.) hhh. our purpose <<u>after</u> the focu↑sing> (0.2) hh. is actually to->to cut off or remove this damaged tissue

While the adaptation in ex.10 was minimal, in what follows the interviewee transforms the implication to be drawn from the metaphor. The excerpt is taken from a report on The Blue Brain, an international project geared at a computerized reconstruction of the human brain (Waldrop, 2012). The interviewee, a project partner, was asked whether he and his team had been able to model a "pinch of brain" (l.3, heb. *bdal*). The term *bdal* was used as a component of a noun phrase that marks its noun as insignificant; it is primarily a literary device whose use in ordinary language is highly infrequent (e.g. *bdal sigaria*; a cigarette butt). Though *bdal* indicates a minute and preliminary achievement it is used by the interviewee to prime the significance of the achievement rather than the small step involved (l.8-9):

ex.11. blue brain project, 7.9.09

YL. now its alrea:dy (.) three year it seems to me that you are wor[king]
IE. [yes]
YL. on the::: (0.2) do have already a pinch of bra↑in=
(0.2)
IE. Ye↑s (0.3) we have a pinch of brain whose size is ten thousand
cells (0.5) hhh.=
YL. Yes=
IE. That's about one millio↑nth of the brain (0.2) we already succeeded in modelling in a
form (0.4) that is complete and accurate

The use of interviewer's terms when making the repair was also observed then the claim was contested. In contrast to examples 10 and 11, the interviewee in ex.12 foregrounds the metaphor that London introduced as only partially suitable for the explanation she is pursuing. This excerpt is taken from a report on the development of a new technology for the production of artificial blood hence eliminating the reliance on blood banks. The interviewee, a medical expert, was asked to explain the complexity of the biological production of blood cells in the body. She described the key hormonal mechanisms while responding to London's formulation of their effects:

ex.12. artificial blood, 19.7.10

IE. The↑y (.) are getti↑nghormo↓nes they are receiving demands from the tissue↑s (.) and
the↑y eventually: (0.2) hh. kno↑w to be (0.3) bloo:d cells (.) or hea:rt cells (.) or
bra↑in cells or ne↑rve cells (.) hhh.=
YL. But we do not kno:w↑ (0.2) eh eh wha:::t is <the nature of the command>
that they [recei↑ve]
IE. [no a pa] rt↑ ((of it))[we know]
IR. [we kno↑w]
IE. what substances are secrete:d we know which hormones are secrete:d we know which
environment this cell needs (0.3)

In ex.12 the interviewee presents hormones as conveying "demands" (l.1; *drishot*) from body tissues to blood cells and thus as "knowing" (l.2, heb. *yod'im*) how to differentiate. By way of a declarative question the interviewer states that scientists do not understand the signals involved, and describes this signal as a "command" (l.4; heb. *pkuda*) rather than a demand. Though this statement is contested by the interviewee, she states that "part" (l.6, heb. *khelek*)

of the command is known, thus exploiting the metaphor that the interviewer introduced. Although the difference in meaning between the demand and command metaphors is recognized, the metaphor is adapted to the explanation that is underway. The adoption and adaptation of metaphoric terms emerges as sensitive to their meaning but mainly responsive to the explanatory task.

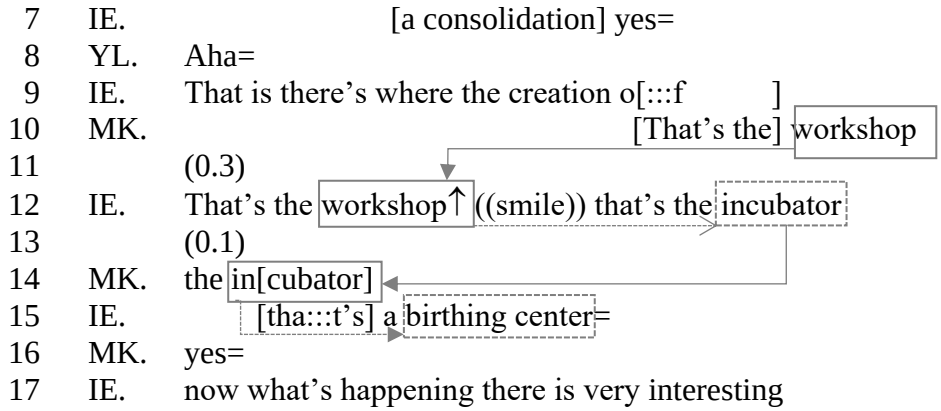
d. Building common sense

Metaphors are considered useful because they build on common sense or familiar experiences or activities that speakers expect the recipients to grasp. Yet as the following examples show, familiarity is not always a given but is often negotiated between journalists or scientists. The metaphors in these examples are used in the search or production of a common or shared ground for sense-making that can communicate the discovery.

In excerpt 13 the speakers initially use different concepts to characterize a nebula but reach a consensus in a few seconds. The interviewer is an astronomer who was invited regularly to explain discoveries in space research reported in this program. In this case, he was explaining the discovery of oxygen in the Orion nebula (heb. *arfilit*) and was asked what a nebula is (l.2). The exchange that developed (l.2-16) can be described as an "inserted sequence" (Schegloff, 2007, 104) launched to address the meaning of this term before the main thrust of the talk was resumed (l.17). However, this explanation was co-produced through an exchange of formulations between the interviewee and the interviewer:

ex.13. oxygen in Orion, 8.8.11

1 IE. now this is very [is very]
2 YL. [what is] a nebula is that =
3 IE. hhh. a nebu:la↑ (0.6) is a place that is (0.3) e:::h (.) you can say (.) an area of gas and
4 dust where sta:rs↑ are formed and solar systems such as [ours]
5 YL. [through]
6 a consolidation [of e:::h]



Kirschenbaum interrupts the interviewee's explanation (l.3-9) and describes nebula metaphorically as a "workshop" (heb. *sadna*; l.10) and this metaphor is ratified (l.12) but immediately repaired by the interviewee to the term "incubator" (heb. (eng.), *incubator*; l.12) and then into the more vernacular expression "birthing center" (heb. *beityoldot*; l.15). These metaphors are not discussed for their reference but introduced as self-explanatory concepts of what a nebula is. The search for a vernacular term responds to a joint-orientation towards completion of this insertion sequence rather than an accurate description of the phenomenon being discussed.

In ex.14 the interviewee takes part in the development of vehicle terms that support and then build on the ironic formulation proposed by the interviewer. The excerpt is taken from an item hosted by guest anchors Raviv Druker, the political correspondent of Channel 10 and Alon Ben-David, the military correspondent of the channel. Both are interviewed regularly on the program. The item reported on a machine developed for the "printing" of artificial tissues. In the opening (not shown) RD presents the machine as an "organs printer" citing this term from a previous publication in *The Economist*.[iv] As in the shopping addiction item, Druker presents the technology somewhat ironically, here asking if it is some kind of joke. The expert in contrast, argues that the machine works on a principle that is practical and feasible, by comparing it to an ordinary printer:

ex.14 organs printer, 4.3.10

IE. It's based↑ on (.) *like a* machine↑ of (.) e::h (0.2) when you see it (.) it's *like a*
printing press hh. (.) an ordinary ((one))
[instead of i:nk]
RD. [((you)) just push] the toner ((smile))
(0.4)
IE. ((smile)) Ye:s replacing toner to a [cell] of this ((type))[or ano:ther]
RD. [yes]
AB. [and then it]
<injects> (0.4) e:h (0.1) a different shape of cells each ti[me]
IE. [Yes] then

The interviewee suggests that the machine works like an ordinary printing press (heb. *mekhonat dfus regila*, l.2) but he marks this metaphor as a comparison (like a; heb. *kmo*) rather than a literal description. As the interviewee extends his analogy to the use of "ink" (l.3; heb. *dyo*) Druker segues in and references the insertion of a printing toner (heb. (engl.) *toner*, l.4) as a familiar practice for viewers without marking this expression as a metaphor. The metaphor is delivered and received ironically but is inserted by Ben-David in a serious question about the working of the machine (l.8-9). As shown in other programs, broadcasters and interviewers often use irony and its entertaining edge to convey critical viewpoints (Dori-Hacohen & Livnat, 2015). Here, the ironical but then serious uptake of the metaphor and the meaning it is understood to convey responds to the need to present complex science lightly.

Whereas inex.14 the expert accepted the term offered by the interviewee, joint formulations were observed even in cases where the agreement was only partial. Ex.15is taken from an item reporting on a cancer treatment that the interviewee applies in his ward. This treatment includes the extraction of immune system cells (lymphocytes) from patients' tumors, culturing them in laboratory conditions and then inserting the enhanced batch into the patients where if successful, they will reach and attack the tumors. This excerpt forms part of an exchange in which the interviewee explains that rationale for selecting these cells in terms of their tumor recognition and specificity:

ex.15 melanoma treatment, 9.9.2010

1 IE. and then ((we)) give these huge quantities of the lymphocytes h. the patient
2 becomes gra[dually rehabilitated]
3 MK. [How do you how do they] know to get precisely there=
4
5 IE. They're being navigated there they're specific↑ to the tumor that's what it's all
6 abou:t h. that's why they're not being [taken]
7 YL. [Aha]
8 IE. from the blood stream or o::[:r from another place]
9 YL. [They've already been educated]
10 by the [opponent]
11 IE. [They were] there
12 (0.5) ((questioning head-node))
13 YL. educated by the opponent
14 (0.3)
15 IE. educated by the opponent but failed to overpower him

The exchange includes two responses by the interviewee to metaphoric constructions that the interviewers introduced in their questions. In the first instance (l.3) the interviewee was asked how these lymphocytes "know" (heb. *yod'im*, l.3) how to get to the tumor. In his response, the interviewee shifts from an agentive to passive description of the cells by describing them as "being navigated" (l.4, heb. *menutavim*) to the tumor by clinicians (l.4). This passive construction is than elaborated by London into a more animated description of the cells as having been educated by their opponent (heb. *khunkhu bi'dei ha'yariv*; l.8-9). Although the interviewee questions this term (l.11) he ratifies the educational metaphor and develops it in a way that supports the formulation initiated by the interviewer. The common ground for sense-making in metaphor emerges not as given but as negotiable and co-constructed to be suitable for presenting the research to the audience.

6. Discussion

Studies of metaphor use in science news reporting have contributed significantly to a better understanding of their explanatory and rhetorical impact in communicating research to the

public. While journalists have been shown to borrow the metaphors that researchers use to describe their research or expert advice (Collin & Hughes, 2011, Stelmach & Nerlich, 2015), the findings here suggest that scientists insert their metaphors in ways that align with the interactional environment in which these are used. The scientists seemed to minimize their repair of the metaphors that the journalists proposed, and preferred instead to incorporate these terms into the explanations they delivered. These results resonate with previous studies in conversation analysis that have identified the minimization of repair as a way of avoiding interruptions to the progressivity of talk (Schegloff et al., 1977, Kitzinger, 2012). These include, as seen here, the embedding of a repaired term into subsequent talk rather than tackling its particular meanings (Jefferson, 1987, Jefferson, 2007, Maynard, 2011).

However, scientific metaphors are typically used to convey topics that are ideationally troublesome to communicate (Cameron, 2003). Discursive studies of metaphor have identified their careful crafting for particular audiences especially when the topic or concepts are considered difficult to grasp (Semino, 2008, Pramling, 2010, Skorczynska & Ahrens, 2015). The lack of concern identified in the current study for an accurate relationship between target and source can be assumed to reflect the experts' understanding of their rights and obligations in the news interview settings. News interviewers often formulate the claims of their interviewees for their audiences (Heritage & Roth, 1995, Romaniuk, 2013). The interviewees here seemed to trade off their epistemic rights and obligations to provide accurate information against interviewers' role in formulating this information for the audience.

The ceding of explanatory power by experts to journalists may also respond to the growing proximity between scientists and journalists that have been shown in recent surveys (Peters,

2013). Though experts are sourced to confirm facts and add credibility to reports (Boyce, 2006), the role of journalists is to attract and maintain their audiences' attention and address their interests and needs (Reich, 2012). Accordingly, while experts are invited to talk as privileged information sources (Montgomery, 2008) they have been shown to adapt their responses to the communicative goals of hosting programs and the agendas set by their hosts (Patrona, 2005, Albaek, 2011). The interactional use of metaphor as shown here suggests that journalists not only set the tone and frame of reports but can impact the actual explanations elicited from scientists.

Scientists often try and are recommended to use metaphors in communicating their research to the general public as a way of linking complex topics to ordinary experiences and understandings (Kapon et al., 2009, Baram-Tsabari & Lewenstein, 2013). Although they can select and tailor metaphors to the explanations they propose (Semino et al., 2013), news reporting involves mediation that can impact the figurative landscape. The applicability of a term and familiarity with the experiences it indexes are not given but rather produced intalks between scientists and journalists. The prevalence of interviewing practices in news gathering and presentation (Ekström & Lundell, 2011, Verhoeven, 2010) gives scientists a voice and opportunity to explain research in their own words. At the same time, they need to consider the interactional context in which their metaphors and their explanations take shape.

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[i] The dictionary selected was Rav-Millim,a comprehensive and regularly updated Hebrew dictionary (Choueka, 1997) that was found useful in previous studies of Hebrew metaphors (Kupferberg, 2014, Flor & Hadar, 2005). The dictionary includes vernacular, metaphorical and at times even scientific meanings for many of the terms examined in this study. The lexical analysis for each metaphor presented in the transcripts is available from the author upon request.

[ii] The transcription notations are as follows:

Speaker turns

YL: Yaron London; MK: Moti Kirschenbaum; RD: Raviv Druker; AB: Alon Ben-David

IE: Interviewee.

Speech delivery

The transcription symbols used in the conversational examples are the following:

[] mark overlapping speech

A dash (-) marks abrupt cut off, = marks 'latched' utterances

Underlining indicates emphasis

(.) marks a pause less or equal to 0.1 seconds.

Time (seconds) marks a pause exceeding 0.1 seconds.

.h stands for in-breadths; .hh .hhh for their extension (timed as pauses)

:A colon marks an extension of the sound it follows; :: a double colon marks a longer extension.

><, <> speech delivery of enclosed words is faster/ slower than the surrounding talk

↑↓ Upward/ downward arrows mark rise/drop in intonation in the following word

heb. Indicates a Hebrew transliteration of lexical strings discussed in the text.

pl. (plural) marks we/they when the grammatical subject cannot be determined

[iii] In Hebrew, encoding (heb. *mekoded*) refers to and works with the notion of computer language and coding while "translate" (heb. *metargem*) is defined by the conventional notion of linguistic translation (Choueka, 1997).

[iv] By date, the report related to is probably: Anon., 2010